ABSTRACT OF THE DISCLOSURE

A periodic structure is illuminated by polychromatic electromagnetic radiation. Radiation from the structure is collected and divided into two rays having different polarization states. The two rays are detected from which one or more parameters of the periodic structure may be derived. In another embodiment, when the periodic structure is illuminated by a polychromatic electromagnetic radiation, the collected radiation from the structure is passed through a polarization element having a polarization plane. The element and the polychromatic beam are controlled so that the polarization plane of the element are at two or more different orientations with respect to the plane of incidence of the polychromatic beam. Radiation that has passed through the element is detected when the plane of polarization is at the two or more positions so that one or more parameters of the periodic structure may be derived from the detected signals. At least one of the orientations of the plane of polarization is substantially stationary when the detection takes place. To have as small a footprint as possible, one employs an optical device that includes a first element directing a polychromatic beam of electromagnetic radiation to the structure and a second optical element collecting radiation from the structure where the two elements form an integral unit or are attached together to form an integrated unit. To reduce the footprint, the measurement instrument and the wafer are both moved. In one embodiment, both the apparatus and the wafer undergo translational motion transverse to each other. In a different arrangement, one of the two motions is translational and the other is rotational. Any one of the above-described embodiments may be included in an integrated processing and detection apparatus which also includes a processing system processing the sample, where the processing system is responsive to the output of any one of the above embodiments for adjusting a processing parameter.